Learner's Book answers

Unit 1

Getting started

1 **a** 2, 3, 5, 7, 11, 13, 17, 19

b The even numbers 22, 24, 26, 28 are not prime. 21 and 27 are multiples of 3. 25 is a multiple of 5. That just leaves 23 and 29 as prime numbers.

2 **a** 1, 2, 3, 6, 9, 18

b 18, 36, 54, 72, 90

c 6

d 36

3 **a** −3 **b** −9 **c** −18

d −2 **e** −2 **f** 4

4 **a** square **b** cube

c cube **d** both square and cube

e square **f** square

5 **a** 10 **b** 5 **c** 9

Exercise 1.1

1 **a**, **b**, **c** and **d** Many different trees are possible. They all end with 2, 2, 2, 3, 5.

2 **a** and **b** Different trees are possible but they should end with 2, 2, 3, 3, 3.

c $108 = 2^2 \times 3^3$

d peer discussion

3 **a** Different trees are possible.

b $200 = 2^3 \times 5^2$

c peer discussion

d There are two different possible trees.

4 **a** Many trees are possible.

b $330 = 2 \times 3 \times 5 \times 11$

5 **a** 20 → **i** $2^2 \times 5$

b 24 → **v** $2^3 \times 3$

c 42 → **ii** $2 \times 3 \times 7$

d 50 → **iv** 2×5^2

e 180 → **iii** $2^2 \times 3^2 \times 5$

6 **a** 315 **b** 1000 **c** 396

d 784 **e** 867

7 **a** $2^2 \times 7$ **b** $2^2 \times 3 \times 5$ **c** $2^3 \times 3^2$

d $3^2 \times 17$ **e** $2 \times 5 \times 19$ **f** $5^2 \times 11$

8 **a** and **b**

Number	Product of primes
35	5 × 7
70	2 × 5 × 7
140	2^2 × 5 × 7
280	2^3 × 5 × 7
560	2^4 × 5 × 7
1120	2^5 × 5 × 7
. . .	. . .

9 **a** $7 \times 11 \times 13$ **b** $2^2 \times 7 \times 11 \times 13$

c $2 \times 3 \times 7 \times 11 \times 13$

10 **a** $132 = 2^2 \times 3 \times 11$ **b** $150 = 2 \times 3 \times 5^2$

c $2^3 \times 3^2 \times 5^2 \times 11$

11 **a** **i** 3×5 **ii** $3^2 \times 5^2$

iii $2^2 \times 7$ **iv** $2^4 \times 7^2$

v $2^2 \times 3^2$ **vi** $2^4 \times 3^4$

b The indices for n^2 are double the indices for n.

c $96^2 = 2^5 \times 3 \times 2^5 \times 3 = 2^{10} \times 3^2$. Double the indices for each factor. This method will work for all numbers.

12 a 4 b 280

13 a 30 b 900

14 a 18 b 540

15 a $3^2 \times 5$ b 3×5^2

c 225 d 15

16 a 1260, many trees are possible.

b peer discussion

17 a $2^2 \times 3^2 \times 11$ b $2^3 \times 3 \times 7$

c 12 d 5544

18 a 2 b 986

19 $63 = 3^2 \times 7$ and $110 = 2 \times 5 \times 11$; they have no common prime factors so the HCF is 1.

20 a 1 b 1739

c If x and y are different prime numbers, the HCF is 1 and the LCM is xy

d peer discussion

Exercise 1.2

1 a $-3 \times 4 = -12$; $-3 \times 3 = -9$; $-3 \times 2 = -6$; $-3 \times 1 = -3$; $-3 \times 0 = 0$; $-3 \times -1 = 3$; $-3 \times -2 = 6$; $-3 \times -3 = 9$; $-3 \times -4 = 12$ and so on.

b The first number is always -3. The second number goes down by 1 each time. The answer goes up by 3 each time.

c $-5 \times 4 = -20$; $-5 \times 3 = -15$; $-5 \times 2 = -10$; $-5 \times 1 = -5$; $-5 \times 0 = 0$; $-5 \times -1 = 5$; $-5 \times -2 = 10$; $-5 \times -3 = 15$; $-5 \times -4 = 20$ and so on. The first number is always -5. The second number goes down by 1 each time. The answer goes up by 5 each time.

d The product of two negative numbers is the same as the product of the corresponding positive numbers. For example, $-6 \times -4 = 6 \times 4 = 24$. You could write this as $-a \times -b = a \times b$.

e learners' own sequence

f peer discussion

2 a -10 b -10

c 10 d 10

3 a 24 b 49

c 60 d 88

4

×	−5	3	−8
4	−20	12	−32
−3	15	−9	24
−6	30	−18	48

5 a -32 b 48

c 12 d -30

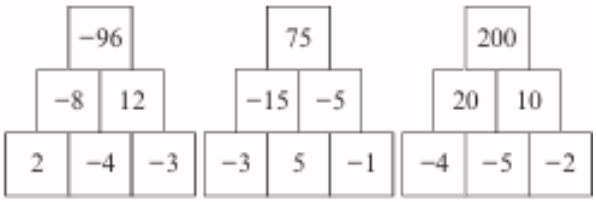
6 a -28 b -33

c 36 d 25

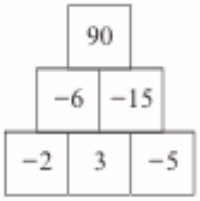
7 a $3 \times -4 = 2 \times -6 = -12$ and $-6 \times -2 = 12 \times 1 = -4 \times -3 = -12 \times -1 = 12$

b There are many possible answers.

8 a b c



9 a



b Zara is incorrect. One possible statement is that the top number is 90, -150 or -60.

10 a 4 b -9

c -4 d -8

11 a $-24 \div 6 = -4$ or $-24 \div -4 = 6$

b learners' examples

c $14 \div -2 = -7$ or $14 \div -7 = -2$

d learners' examples

e learners' own conjectures

f peer discussion

12 a -3 b 7

c -5 d 3

e -7 f 6

g -12 h 5

13 **a**

	−30	
−5		6
5	−1	−6

b

	−96	
12		−8
−6	−2	4

c

	−200	
10		−20
2	5	−4

14 **a** 6 **b** 6

c −3 **d** −3

15 **a** $x=-32$ **b** $x=45$

c $x=-8$ **d** $x=-5$

16 **a** −3 **b** −3

c 7 **d** 5

17 **a** 1500 **b** −1200

c 7 **d** −5

Exercise 1.3

1 **a** 49 **b** 49

c 343 **d** −343

2 **a** 5 **b** −3

c −1 **d** −2

3 **a** $x=10$ or -10 **b** $x=12$ or -12

c $x=1$ or -1 **d** $x=0$

e no solution

4 **a** $x=6$ **b** $x=-3$

c $x=-1$ **d** $x=-5$

5 **a** 27 **b** no solution

c 9 **d** −9

6 **a** $\sqrt{8^2}=\sqrt{64}=8$ as the calculator only gives the positive square root, and $\sqrt{(-8)^2}=\sqrt{-8\times-8}=\sqrt{64}=8$, so the difference is 0.

b $\sqrt[3]{4^3}-\sqrt[3]{(-4)^3}=4-(-4)=4+4=8$

7 The integer is 10 or −10 so the cube is $10^3=1000$ or $(-10)^3=-1000$

8 **a** $3\times13=39$ **b** $x=39$ or -39

9 **a** $-5^2=-25$ but $(-5)^2=+25$

b There is no difference: $-5^3=-(5\times5\times5)=-125$ and $(-5)^3=-5\times-5\times-5=-125$

10 **a** $3^2+4^2=9+16=25=5^2$

b **i** True: $(-3)^2+(-4)^2=9+16=25=(-5)^2$

ii True: $12^2+(-5)^2=144+25=169=(-13)^2$

iii False: $8^2=64$ but $-10^2-6^2=-100-36=-136$ which is not the same.

c peer discussion

11 **a** **i** $2^2+2=4+2=6$

ii $(-3)^2+(-3)=9-3=6$

b **i** $3^2+3=9+3=12$

ii $x=-4$

c $x=4$ or -5

d One solution is a positive integer n and another is $-(n+1)$.

Another equation like this is $x^2+x=30$ which has the solution $x=5$ or -6

e peer discussion

12 **a**

x	$x-1$	x^3-1	x^2+x+1
2	1	7	7
3	2	26	13
4	3	63	21
5	4	124	31

b The third column divided by the fourth column = the second column.

That is $(x^2+x+1)\div(x^3-1)=x-1$

c The next row is 6, 5, 215, 43 and $215\div43=5$

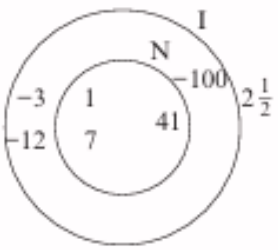
d The result is the same for negative values of x.

e peer discussion

13 **a** 5, −500, 16 **b** 5, 16

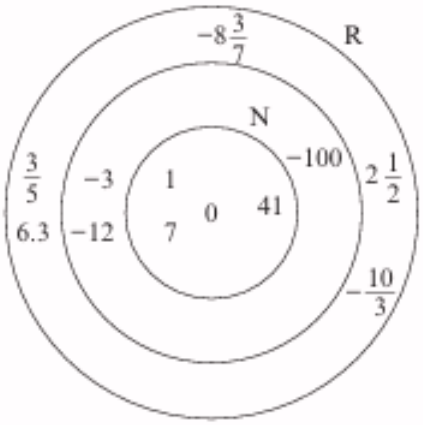
c all six numbers: $5, -\frac{1}{5}, -500, 16, -4.8, 99\frac{1}{2}$

14 **a** and **b**



Learners may omit $2\frac{1}{2}$ from the Venn diagram.

c and **d**



e Peer discussion may lead to argument about 6.3 which is rational because it can be written as $6\frac{3}{10}$.

Exercise 1.4

1

Power	2^0	2^1	2^2	2^3	2^4	2^5	2^6	2^7	2^8	2^9	2^{10}
Number	1	2	4	8	16	32	64	128	256	512	1024

2

Power	3^0	3^1	3^2	3^3	3^4	3^5	3^6	3^7	3^8
Number	1	3	9	27	81	243	729	2187	6561

3 **a** **i** $2^3 \times 2^2 = 2^5$ **ii** $2^4 \times 2^3 = 2^7$

iii $2^2 \times 2^5 = 2^7$ **iv** $2^1 \times 2^7 = 2^8$

v $2^4 \times 2^5 = 2^9$

b Add the indices to get the index of the answer. Learners' own examples.

c The same rule applies. Learners' own examples.

d The rule works for powers of any positive integer.

4 **a** 6^5 **b** 6^5 **c** 6^7 **d** 6^6

5 **a** 10^5 **b** 20^6 **c** 15^6 **d** 5^8

6 **a** $6561 \times 3 = 19683$ **b** $15625 \times 5 = 78125$

7 **a** 3^2 **b** 9^5 **c** 12^2 **d** 15^7

8 The first part is correct because $4^2 = 16 = 2 \times 2 \times 2 \times 2 = 2^4$.
The second part is not correct because $4^3 = 4 \times 4 \times 4 = 64$ but $3^4 = 3 \times 3 \times 3 \times 3 = 81$

9 **a** 10^9 **b** 10^{12}

10 **a** 2^6 **b** 3^9 **c** 5^7 **d** 10^9

11 **a** 3^6

b **i** 2^6 **ii** 5^6 **iii** 4^6

iv 15^8 **v** 10^{12}

c **i** N^6 **ii** N^8 **iii** N^{15}

d To find a power of a power you multiply the indices $(N^a)^b = N^{ab}$

12 **a** **i** $2^6 \div 2^2 = 2^4$ **ii** $3^4 \div 3^1 = 3^3$

iii $2^9 \div 2^4 = 2^5$ **iv** $3^6 \div 3^2 = 3^4$

v $3^2 \div 3^2 = 3^0$

b learners' own examples

c When you divide powers you subtract the indices.

d peer discussion

13 **a** 2^2 **b** 10^3 **c** 15^2

d 8^1 or 8 **e** 2^4 **f** 2^0 or 1

14 **a** 9^7 **b** 9^3 **c** 9^{10}

d 5^9 **e** 12^5 **f** 7^9

g 10^0 or 1

15 **a** Yes: $(5^2)^3 = 5^2 \times 5^2 \times 5^2 = 5 \times 5 \times 5 \times 5 \times 5 \times 5$
$= (5 \times 5 \times 5) \times (5 \times 5 \times 5) = (5^3)^2$

b Yes

16 **a** $3^2 \times 5^2$ **b** $3^3 \times 5^3$

c $3^5 \times 5^5$ **d** $3^8 \times 5^8$

17 **a** 5^2 **b** 5^0

c You might suggest 5^{-2}.

Check your progress

1 **a** Different trees are possible. They all end with 2, 5, 5, 7

b $350 = 2 \times 5^2 \times 7$

c $112 = 2^4 \times 7$

d 14

e 2800

2

×	−6	−5	7
−10	60	50	−70
3	−18	−15	21
−7	42	35	−49

3 **a** No: $(-5)^2 = 25$

b No: $-9 \times -11 = 99$

c No: $45 \div -9 = -5$

d Yes

4 **a** -8 **b** 6

c -20 **d** -10

5 **a** $x = 6$ or -6 **b** No solution

c $x = 2$ **d** $x = -3$

6 **a** 3 **b** 0

7 **a** 36 **b** -18

8 **a** 8^5 **b** 8^4 **c** 8^0 **d** 8^9

9 **a** 2^{12} **b** 3^8

Unit 3

Getting started

1 **a** 45 **b** 180

c 8200 **d** 460

2 **a** 7 **b** 34.2

c 1.4 **d** 31.2

3 **a** A 7.2 **b** B 12.5 **c** B 0.8

4 **a** 4.59 **b** 0.6723

c 54.789 **d** 12.050 30

Exercise 3.1

1 **a** 2 **b** 20 **c** 200 **d** 0.2

2 **a** 4 **b** 400 **c** 0.4 **d** 40

3 **a** learners' answers

b **Sofia:** When I multiply 56 by 0.01, I move the digits 5 and 6 two places to the right in the place value table. This gives me an answer of 0.56

Arun: When I multiply 56 by 0.01, I move the decimal point two places to the left. This gives me an answer of 0.56

4 **a** 6.2 **b** 5.5 **c** 12.5

d 0.32 **e** 0.37 **f** 6.55

g 7.5 **h** 0.04

5 **a** 20 **b** 200

c 2000 **d** 2

6 **a** 400 **b** 4000

c 40 000 **d** 40

7 **a** learners' answers

b $0.45 \div 0.1 = 4.5$ and $78 \div 0.01 = 7800$

8 **a** 70 **b** 45 **c** 5220

d 6.7 **e** 200 **f** 850

g 32 **h** 722.5

9 **a** 1.8 **b** 0.236

c 6 **d** 450

10 **a** ÷ **b** × **c** ×

d × **e** ÷ **f** ÷

11 **a** 0.01 **b** 0.1 **c** 0.01

d 0.1 **e** 0.1 **f** 0.1

12 **a** 12.5 g **b** 0.8 g

c Yes, multiplying by 0.1 is the same as finding 10%.

d 1%. Multiplying by 0.01 is the same as finding 1%.

13 **a** A, F and J all equal 2.4, B, E and H all equal 24, C, G and I all equal 240

b D is left over and equals 2400. Any two calculations that give 2400, e.g. $240 \div 0.1$, $24\,000 \times 0.1$ or $240\,000 \times 0.01$

14 125

15 **a** learners' answers

Example: $-4 \times 0.1 = -0.4$, which is not greater than zero

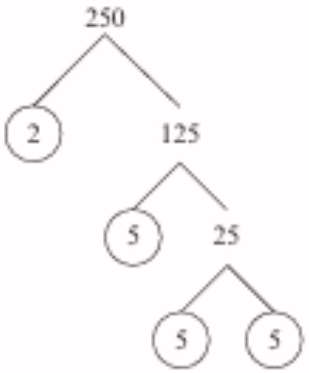
b learners' answers

Example: $0.4 \div 0.01 = 40$, which is not greater than 100

Workbook answers

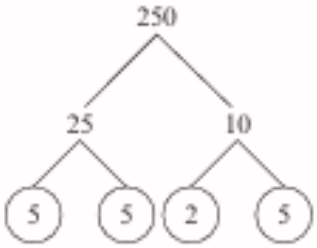
Exercise 1.1

1 a



b No. The 125 can only become 5×25 and 25 as a factor of primes must be 5×5.

c



d $250 = 2 \times 5^3$

2 a & b Many trees are possible but all end with 2, 2, 3, 5, 5.

c $300 = 2^2 \times 3 \times 5^2$

3 a i 2×3 **ii** $2 \times 3 \times 5$

iii $2 \times 3 \times 5 \times 7$

b $2 \times 3 \times 5 \times 7 \times 11 = 2310$; multiply the last number by the next prime

4 a 42

b 1764

c 74088

5 a Many trees are possible

b $8712 = 2^3 \times 3^2 \times 11^2$

6 a $96 = 2^5 \times 3$

b 97 is a prime number

c $98 = 2 \times 7^2$

d $99 = 3^2 \times 11$

7 a $70 = 2 \times 5 \times 7$

b $70^2 = 2^2 \times 5^2 \times 7^2$

c $70^3 = 2^3 \times 5^3 \times 7^3$

8 a i 3^2 **ii** $2^2 \times 3^2$

iii 3^4 **iv** $2^4 \times 3^2$

v $3^2 \times 5^2$ **vi** $2^6 \times 3^2$

vii 5^4 **viii** 7^4

b There is an even number of each prime factor.

c Using the result of part b, it is the square of $2^2 \times 3 \times 5 \times 7$.

9 a $3^2 \times 7 = 63$

b $3 \times 5 = 15$

c $2^2 \times 3 = 12$

10 a 360 **b** 300 **c** 1800

11 a $104 = 2^3 \times 13$

b $130 = 2 \times 5 \times 13$

c 26

d 520

12 a $135 = 3^3 \times 5$

b $180 = 2^2 \times 3^2 \times 5$

c 45

d 540

13 a $343 = 7^3$

b $546 = 2 \times 3 \times 7 \times 13$

c 7

d 26 754

14 630

15 a 24 **b** 1848

16 a $48 = 2^4 \times 3$ and $25 = 5^2$; there are no common prime factors, therefore the HCF is 1.

b 1200

17 18 and 24

Exercise 1.2

1 $-1\times-4=4$; $-3\times-4=12$; $-5\times-4=20$

2 **a** -40 **b** 40 **c** 99 **d** 120

3 A, B, D, F in one group and C, E in the other

4

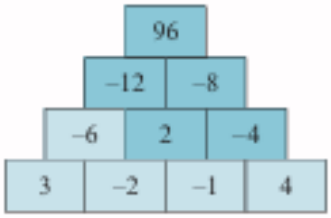
×	2	−4	−9
−6	−12	24	54
5	10	−20	−45
−8	−16	32	72

5 **a** 35 **b** −5 **c** 35 **d** 5

6 **a** 24 **b** −66 **c** 81 **d** 16

7 $(-6)^2+(-8)^2-(-10)^2=36+64-100=0$

8 **a**



b If 3 and −2 are swapped and −1 and 4 are swapped, then the top number will be 3456.

9 **a** 1×-6 or -1×6 or 2×-3 or -2×3

b 1×6 or -1×-6 or 2×3 or -2×-3

10 **a** $63\div-9=-7$ or $63\div-7=-9$

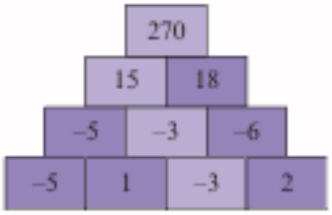
b $-84\div12=-7$ or $-84\div-7=12$

11 **a** −6 **b** 5 **c** −9 **d** 13

e −12

12 **a** −3 **b** 2 **c** −8 **d** −4

13



14 **a** −6 **b** 12 **c** −12 **d** 8

15 **a** 32 **b** −40 **c** −4 **d** −5

16 **a** True. $-3\times(-6\times-4)=-3\times24=-72$ and $(-3\times-6)\times-4=18\times-4=-72$

b False. $-24\div(-4\div-2)=-24\div2=-12$ and $(-24\div-4)\div-2=6\div-2=-3$

Exercise 1.3

1 **a** 196 **b** 196 **c** 400 **d** 900

2 **a** 64 **b** −216 **c** −1000 **d** 0

3 **a** impossible **b** −4

c −5 **d** −9

4 **a** $x=5$ or -5 **b** $x=15$ or -15

c $x=9$ or -9 **d** no solution

5 **a** $x=6$ **b** $x=-6$

c $x=-10$ **d** $x=-20$

6 **a** $x=23$ or -23 **b** no solution

c $x=23$ **d** $x=-23$

7 **a** true **b** false **c** true

d true **e** true

8 **a**

x	−3	−2	−1	0	1	2
x^2+x	6	2	0	0	2	6
x^3+x	−30	−10	−2	0	2	10

b **i** $x=-2$ or 1

ii $x=1$

9 **a** Yes. If $x=5$ then $x^3-x=5^3-5=125-5=120$

b No. If $x=-5$ then $x^3-x=-125--5=-120$

10 **a** $64=2^6$

b $2^6=(2^3)^2=8^2$ and $(2^2)^3=4^3$

c $729=3^6$

d $3^6=(3^3)^2=27^2$ and $(3^2)^3=9^3$

e 1 is both a square number and a cube number. So is $4^6=4096$ or $5^6=15\,625$; other answers are possible.

11 $x^6=64$

So $(x^3)^2=64$

So $x^3=8$ or -8

If $x^3=8$ then $x=2$

If $x^3=-8$ then $x=-2$

There are two possible answers, $x=2$ or -2

Exercise 1.4

1 **a** 3^3 **b** 7^4 **c** 12^6 **d** 15^5

2 **a** 6^6 **b** 10^7 **c** 3^9 **d** 14^7

3 **a** $2^0+2^1+2^2+2^3=1+2+4+8=15=16-1=2^4-1$

b 2^6-1

c No. $3^0+3^1+3^2+3^3=1+3+9+27=40$ and $3^4-1=81-1=80$ so they are not equal.

4 **a** 5^6 **b** 15^6 **c** 7^9 **d** 3^{20}

5 **a** 2^2 **b** 2^6 **c** 3^6

6 **a** 5^8 **b** 5^{12} **c** 5^{16}

7 **a** 4^3 **b** 7^2

c 15^3 **d** 15^0 or 1

8 **a** 8^2 **b** 5^4 **c** 2^8 **d** 3^3

e 12^0 or 1

9 **a** 6^3 **b** 6^4 **c** 6^8 **d** 6^6

10 **a** 2^7 **b** 3^3

c 2^4 or 4^2 **d** 3^0 or 1

11 **a** 5^3 **b** 5^6 **c** 5^{12}

12 **a** 12^8 **b** 12^{12} **c** 12^2

13 No, Marcus is not correct.

$2^4=2\times2\times2\times2=16$ and $4^2=4\times4=16$ so these are equal.

However $3^4=3\times3\times3\times3=81$ and $4^3=4\times4\times4=64$ and these are not equal.

Exercise 3.1

1	a	2	b	7	c	8	d	7.5
2	a	3	b	5	c	8	d	6.5
3	a	12	b	1.2	c	120	d	0.12
4	a	40	b	70	c	200	d	250
5	a	200	b	500	c	3000	d	1200
6	a	160	b	1.6	c	16	d	1600
7	a	3.3	b	99.9	c	3		
	d	0.87	e	0.77	f	0.7		
	g	7	h	0.07				
8	a	50	b	56	c	556		
	d	5.5	e	500	f	560		
	g	5560	h	55				
9	a	2.7	b	0.279	c	2	d	270
10	a	÷	b	×	c	÷	d	×
	e	÷	f	×				

11 **a** 0.1 **b** 0.1 **c** 0.01 **d** 0.1

e 0.01 **f** 0.01

12 **D** is the odd one out as it equals 9600.
A, **B** and **C** all equal 0.96

13 **a** $0.12\,m^2$ **b** \$1.95

14 **a** $b = \frac{2A}{h}$ **b** 23.2 m

15 2.34

16 **a** $0.1 + 0.1 = 1$ which is not bigger than 1

b learners' examples; any number smaller than 1.00

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